IGES 5.0 Recommended Practices Guide

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ABSTRACT

The IGES 5.0 Recommended Practices Guide is intended to assist both users and implementors of the Initial Graphics Exchange Specification (IGES) Version 5.0. It contains two types of information: explanations of implementation practices that are alternatives to those documented in the Specification, including preferred alternatives where preferences exist, and clarifications of ambiguities or omissions in the Specification. Explanatory Recommended Practices address topics such as the explanation of complex areas in the Specification, testing methods, processor performance considerations and the mapping of vendor entities into the set of IGES entities. Recommended Practices that clarify an ambiguity or omission are usually preludes to changes in the Specification.

The Recommended Practices Committee of the IGES/PDES (Product Data Exchange using STEP) Organization (IPO) prepares the Recommended Practices Guide. Interested users and implementors from a variety of organizations prepare and donate material for the document. Suggestions for future topics or completed forms which propose new Recommended Practices (see Appendix A) should be sent to the Chairman of the Recommended Practices Committee in care of the IPO Chairman, National Institute of Standards and Technology, Bldg. 220, Rm. A127, Gaithersburg, MD, 20899.

The IPO Chairman's Committee has reviewed each of these Recommended Practices for accuracy and acceptability to the general IGES community. In general, while preferred techniques are sometimes offered, no individual techniques are endorsed. The final choice of technique can be made only in conjunction with the details of the environment such as the system, the processor, and the application.

Table of Contents

INTRODUCTION

The Initial Graphics Exchange Specification (IGES) Version 5.0 document specifies the structure and meaning of an IGES file. It is intended to be a concise explanation of the IGES file and entity formats and, in general, does not give detailed explanations of the underlying concepts or of the reasoning behind particular choices when alternative representations are available.

In addition, the Specification document does not provide information on how to implement translators or on how to exchange data. This is especially a problem when decisions must be made for approximations. The Recommended Practices (RP) Guide is a collection of practices intended to help write translators. It is not a cookbook on how to write translators, but rather a collection of implementation issues that people have encountered. In most cases the practice will list a suggested solution. In some cases there is no suggested solution as more than one may be equally appropriate. It is still deemed helpful to alert implementors to each solution.

The Specification and RP Guide are meant to complement each other. Since RPs can be handled more quickly than Requests for Change (RFCs), some RFCs will be preceded by an RP. It is important to understand that RPs are NOT part of the Specification, but are guidelines; therefore compliance with them is NOT required.

Sometimes, an RP is used as the basis for an RFC, which ultimately generates an Edit Change Order (ECO) to the Specification. When this happens, the corresponding RP becomes inoperative, and the next release of the RP guide reflects this fact; the RP number and Problem Statement are retained, but the other sections, tables, and illustrations are deleted.

SUBMISSION PROCEDURE

This section explains how to prepare and submit a Proposed Recommended Practice (PRP) as well as the process a PRP follows while under consideration by the Recommended Practices Committee.

Anyone may submit a PRP. Submissions should be made on the form provided in Appendix A of this Guide. Contents should conform to the following format. If approved, the PRP will be rewritten to ensure a uniform standard of clarity and grammar.

Preparing the Form for a Proposed Recommended Practice

PRP Number: The PRP number and revision letter are assigned by the person responsible for RP change control. They help to keep track of the PRP as it progresses through the approval process.

Date: Use the date of the submission of the PRP. For a revision, use the date that the revision is submitted to the RP change control person.

Number of Pages: Include the number of pages to indicate the total length of the complete PRP.

Author's Name: Fill in the author's name and address so that questions and discussion can be directed to the appropriate person.

Affected Processors: Show whether the PRP applies to preprocessors, postprocessors, both, or neither (write "none").

Category: Indicate which of the following standard categories for RPs the PRP addresses.

Software Practice	Implementation Rationale
Conversion Method	Entity Mapping
Hierarchy Rule	Text
Documentation	Workaround
Performance	IGES Description
Testing Method	Clarification

Affected Entities: List any IGES entities affected by the PRP. Use both the name and the entity number.

Keywords: List the major headings under which the PRP should be indexed. The RP manual includes an index of RPs by category and by keyword.

Topic: This item provides a title for the PRP. It should be concise without being cryptic.

Body of PRP: The rest of the PRP is the most important. It should be written to maximize the reader's understanding of the problem and of the proposed solution. The body should contain the following headings:

    Problem Statement
    Solution
    Rationale
    Alternatives Considered
    Selected Methodology

Problem Statement: The Problem Statement section should contain a clear, concise description of the problem that prompted the PRP. The description should be as general as possible, but should use examples where necessary to enhance clarity.

Solution: The Solution section should contain an **abstract** of the recommended solution to the problem. Give a detailed explanation with examples in the Rationale section.

Rationale: The Rationale section should contain an explanation of the alternative approaches considered, the recommended solution, and the reasons for selecting the recommended solution. Use examples liberally. The subheadings can be used to organize material in this section.

Alternatives Considered: The Alternatives Considered section should contain a list of the different solutions developed. Examples aid clarity and should be used liberally. In addition to explaining the different alternatives, include a brief discussion of the advantages and disadvantages of each alternative, including the one eventually chosen.

Selected Methodology: The Selected Methodology should contain the chosen alternative and an explanation of why it was selected. Justify the alternative here, and explain final details of the solution.

APPROVAL PROCEDURE

Completed forms which propose new Recommended Practices (see Appendix A) should be sent to the Chairman of the Recommended Practices Committee in care of the IPO Chairman, National Institute of Standards and Technology, Bldg. 220, Rm. A127, Gaithersburg, MD, 20899. The PRP will be distributed and discussed at the next meeting of the IGES Recommended Practices Committee.

After discussion and possible modification, the Committee will either adopt or reject the PRP. If the PRP is adopted, it will be prepared for production and included in the next release of the Recommended Practices Guide.

The IGES RFC Review Committee, which is composed of the chairmen of the various IGES technical committees, will review the final version of each release of the Recommended Practices Guide and approve it for publication.

RP 1: DELIMITER

Category: Software Practice   **IGES Document Version:** All

Keywords: Parameter Delimiter   **Affected Processors:** Both

       Record Delimiter   **Affected Entities:** None

Problem Statement:

Since it is likely that certain characters will be used to convey relevant information in the parameter data section, using these symbols for either delimiter character or end of parameter character will cause parsing difficulties in the postprocessor.

{ This RP has been resolved by IGES Version 4.0 }

RP 2: WITNESS LINE SUPPRESSION

Category: Software Practice   **IGES Document Version:** All

Keywords: Blank Status   **Affected Processors:** Pre

           Annotation   **Affected Entities:**

           Directory Entry   Witness Line
                                     (106, form 40)

Problem Statement:

Witness lines used in annotation entities may be suppressed by two methods.

Alternatives Considered:

Do one of the following to suppress witness lines:

1. Place a 0 in the witness line pointer field of the annotation entity.

2. Set the blank status in the directory entry of the copious data entity.

Method 1 is confusing because during postprocessing it is impossible to determine whether the annotation entity lacks witness lines entirely or has blanked witness lines; it also prevents the IGES file from communicating the parameterization of blanked witness lines.

Selected Methodology:

Method 2 should be used whenever a witness line exists in an annotation entity, whether or not it is blanked. Method 1 should be used only if the witness line is not present in the annotation entity.

RP 3: TRANSFORMATIONS OF NESTED SUBFIGURES

Category: Hierarchy Rule

Keywords: Matrix Processing

Directory Entry

Subfigure

IGES Document Version: All

Affected Processors: Both

Affected Entities:

Subfigure Def. (308)

Subfigure Inst. (408)

Problem Statement:

Before placement of a Subfigure Instance during IGES postprocessing, any defining matrix and applied scale factors must operate on each entity. Where nesting (subfigure within subfigure) is used, the order of operations for scaling and translating must be consistent between preprocessors and postprocessors. The explanation in the Specification is not sufficiently clear.

{ This RP has been resolved by IGES Version 4.0 }

RP 4: TRANSFORMATION MATRIX PROCESSING

Category: Performance   **IGES Document Version:** All

Keywords: Identity Matrix   **Affected Processors:** Pre

       Directory Entry   **Affected Entities:**

       Matrix Processing   Transform. Matrix (124)

Problem Statement:

The identity matrix in field 7 of a DE record can be identified in several ways.

Alternatives Considered:

1.   Use a pointer to an identity matrix (124).

2.   Use the "default" value of 0.

Selected Methodology:

For processing efficiency, it is preferable to use a zero in field 7 of the DE rather than to use a pointer to an identity matrix.

RP 5: SYSTEM ID PARAMETER

Category: IGES Description   **IGES Document Version:** All

Keywords: Global Parameter 5   **Affected Processors:** Pre

          System ID   **Affected Entities:** None

          Global Section

Problem Statement:

Questions have arisen concerning the contents of Global Parameter 5, the System ID.

{ This RP has been resolved by IGES Version 4.0 }

RP 6: MAGNETIC TAPE FORMAT

Category: Software Practice   **IGES Document Version:** All

Keywords: Tape Parity   **Affected Processors:** Both

        ASCII Code   **Affected Entities:** None

        Tape Format

Problem Statement:

There is no standard for the exchange of IGES data on physical media such as magnetic tape.

Alternatives Considered:

Media to be used for data transfer should be agreed upon by the sender and receiver of the data. Possible methods include magnetic tape, floppy diskettes, or telecommunications.

Selected Methodology:

Based on ANSI X3.39-1973 and ANSI X3.22-1973, use magnetic tape with the following characteristics:

- o   One-half inch tape
- o   Unlabeled
- o   1600 BPI density
- o   9 track
- o   7 bit ASCII code (8th bit zero)
- o   80 character fixed length records
- o   10 records per tape block (This implies a block size of 800; 80 character length * 10 records)
- o   A single end of file mark separates IGES data sets on tape
- o   Multiple consecutive end of file marks signal the end of tape data.

RP 7: MAXIMUM COORDINATE VALUE

Category: Software Practice   **IGES Document Version:** All

Keywords: Global Parameter 20   **Affected Processors:** Pre

Max. Coordinate Value   **Affected Entities:** None

Global Section

Problem Statement:

The preprocessor sets Global Parameter 20 to the largest value
of the system, not to the largest value of the model.

Selected Methodology:

If possible, evaluate the model and determine the actual Maximum
Coordinate Magnitude (MCM) in global space. Global Parameter 20
should be set such that:

o   any $|X,Y,Z| <$ G20 and

o $|G20| < 1.2 *$ MCM.

If the MCM is not calculated, do not set Global Parameter 20 to
the maximum size of any model of the system; instead, use default
parameter (",,").

RP 8: INDEPENDENT WITNESS LINES

Category: Entity Mapping	**IGES Document Version:** All
Keywords: Subord. Entity Switch	**Affected Processors:** Both
DE Level Number	**Affected Entities:**
	Witness Line
	(106, form 40)

Problem Statement:

Several systems have native database data structures in which the dimension witness lines are not linked to a "parent" entity (e.*g.*, linear dimension, angular dimension). The IGES data files produced from these systems contain copious data (form 40) witness lines which are "independent" and dimension entities with the witness line pointers equal to zero. Conversely, many other systems have native database structures in which the "parent" entity always contains the references to witness lines and independent witness lines are not allowed. In moving an IGES file between these systems, especially from the former to the latter, an alternative mapping is needed to retain the witness line.

Selected Methodology:

Preprocessors should retain the "parent" structure whenever possible. Postprocessors for receiving systems which cannot support "independent" witness lines should map the copious data (106, form 40) to corresponding geometry entities (lines and arc segments). These entities should be placed on a graphics level (or associated with special attributes) to distinguish them from the legitimate model geometry.

An unused graphics level could be assigned by the postprocessor, or the graphics level could be selected by the user when the postprocessor is invoked. In either case, a message should be provided indicating the attributes which distinguish "witness line geometry" from "model geometry." If independent lines are used, the entity use flag should be set to "annotation."

RP 9: POSTPROCESSOR DIAGNOSTICS

Category: Documentation

Keywords: Error Message

       Postprocessor
       Robustness

IGES Document Version: All

Affected Processors: Post

Affected Entities: None

Problem Statement:

IGES postprocessors often discontinue processing after an error is encountered in the file, and do not provide meaningful error messages.

Selected Methodology:

The functions of an IGES postprocessor are similar to those of a compiler. The postprocessor should recognize errors encountered when an IGES file is processed, should provide the user with an indication of the error, and should, if possible, continue processing the file.

The key elements of a diagnostic capability are:

1. **Determine Seriousness of Error.** The postprocessor determines the impact the error will have on the processing of the file, and categorizes the error. Possible categories include **FATAL ERROR, ERROR, WARNING.**

2. **Continue Processing when Possible.** After an error is identified, the postprocessor attempts to continue processing the file. Many errors will not prevent processing, and multiple errors that may exist will need to be identified. Options can be included to stop processing if a fatal error occurs, or if a specific number of errors occur, to avoid wasting CPU time when a file is not processable.

3. **Provide Meaningful Error Messages.** The postprocessor provides complete error messages that include a description of the error and the location of the error in the file. The postprocessor also should provide a summary description of the error and the actions taken, for display on a terminal.

    The following is a list of some common errors. This list is not complete but contains a variety of errors. After each error message, the list contains a suggested

action. The processor may need to take some corrective
action before continuing after non-fatal errors. Always
output some type of message to the user.

POSSIBLE ERROR	SUGGESTED ACTION
Global delimiters in error	Terminate
Tape format--not ASCII	Terminate
Binary section missing--binary format	Terminate
Entity not supported	Bypass & continue
Global version not supported	Bypass & continue
No end of record delimiter	Bypass & continue
Terminate section missing	Continue
DE section missing	Terminate
Sequence field	
Out of order	Continue
Missing	Continue
Wrong format	Continue
Parameters	
Wrong type	Use default & continue
Invalid value	
106--(IP parameter not equal to 1,2,3)	Adjust & continue
Endpoints not on circle/conic	Adjust & continue
Pointers not in DE range	Continue
Out of range	Continue

RP 10: TEXT FONT 0

Category: Text

Keywords: Text Font

General Note

IGES Document Version: All

Affected Processor: Both

Affected Entities:

General Note (212)

Problem Statement:

Section 4.2.9 of Version 2.0 of IGES states that "font 0 is an old symbol font and should no longer be used." At the same time, one of the philosophies of IGES development has been to maintain upward compatibility. These two items appear to conflict.

Alternatives Considered:

1. Eliminate the use of font code 0 by all preprocessors and postprocessors.

2. Support the acceptance of font code 0 by postprocessors only.

Advantages/Disadvantages:

Dis. #1   Font code 0 was supported in version 1 of the document. Files may have been generated that already contain font code 0. These files would no longer be processable.

Adv. #2   Font code 0 would no longer be generated, but those files that already contain font code 0 would still be processable. Further, font code 0 could eventually be removed by processing the data back to IGES.

Selected Methodology:

Alternative 2.

RP 11: USER INTERFACE

Category: Documentation	**IGES Document Version:** All
Keywords: Summary Report	**Affected Processors:** Both
Information Message	**Affected Entities:** None

Problem Statement:

Users are having difficulty determining the status of translators as they process and have little or no information on the actions completed by a processor.

Alternatives Considered:

The basic approach is to:

1. Provide a mechanism to inform the user that processing is continuing in a "normal" fashion.

2. Provide a summary report containing the entity types and counts processed at completion.

Item 1 can be addressed in an interactive session by sending a message to the workstation after each "n" entities where "n" could be 1 to 10. The message could include the DE pointer to verify that a loop situation has not occurred. Some implementations currently provide no clue as to how much (or how little) conversion has been completed.

Item 2 can be addressed by generating a summary report consisting of:

   o   translator name and version

   o   entities input, by type and count

   o   entities output, by type and count

   o   errors encountered, identified by entity type, count, condition, and DE pointer

   o   processing time (wall and CPU)

Selected Methodology:

The items listed above suggest alternatives to solve this problem. The decision to include all items, a subset, or other indicators is left to the discretion of the implementor.

RP 12: FLAG NOTE RESTRICTIONS

Category: IGES Description   **IGES Document Version:** All

Keywords: Flag Note   **Affected Processors:** Pre

                               Affected Entities:

                                    Flag Note (208)

Problem Statement:

A flag note with multi-line text causes problems in determining
the size of the flag.

      { This RP has been resolved by IGES Version 4.0 }

RP 13: VIEWS FOR TRANSFORMATIONS

Category: Software Practice

Keywords: Extra View

        Coordinate System

       . Matrix Processing

IGES Document Version: All

Affected Processors: Post

Affected Entities:

        Transform. Matrix (124)

Problem Statement:

The <u>PDDI Report</u>* found that several postprocessors create a separate view for each transformation matrix resulting in a proliferation of views.

Selected Methodology:

The postprocessor should move the data to its appropriate position without creating a new view. This is even more important for conics since the transformation matrix is always required for moving conics to their final placement.

* Product Definition Data Interface, Task I - Evaluation & Verification of ANSI Y14.26M Standard, IGES Committee Presentation by Booz, Allen & Hamilton Inc. October 18, 1983.

RP 14: TRANSLATOR DOCUMENTATION

Category: Documentation   **IGES Document Version:** All

Keywords: Manual   **Affected Processors:** Both

       Error Message   **Affected Entities:** None

       Information Message

Problem Statement:

The PDDI Report identified documentation as a problem.

Selected Methodology:

The following is the minimum set of documentation:

1. Formal manuals:

    o Installation and execution instructions

    o Translation tables including entity support, mappings, approximations, and support limitations

    o User options

    o Error messages and any compensatory action.

2. Translation Messages:

    o Error messages

    o Informative messages

    > **EXAMPLES:**

    > A message indicating that a particular entity was not supported.

    > A message indicating that a font was not supported and another was substituted.

RP 15: ZERO RADIUS ARCS

Category: Software Practice   **IGES Document Version:** All

Keywords: Invalid Data   **Affected Processors:** Both

Circular Arc   **Affected Entities:**

Circular Arc (100)

Problem Statement:

Some preprocessors write arcs of zero radius. This can occur for two reasons: (1) Either the user put a zero radius arc in his part, or (2) the magnitude of the coordinates of the center point was much greater than the radius of the arc, and precision errors caused the center point and endpoints of the arc to be coincident. Of these two possibilities, it appears that precision problems are not nearly as common as user-generated zero radius arcs.

Alternatives Considered:

1.   If the radius and center point of an arc are such that the radius cannot be properly represented with adequate precision, then the preprocessor should define the arc with its center at the origin, and use a transformation matrix to move the arc into its correct position.

2.   If the user puts a zero radius arc in his part, it is invalid.

3.   If a zero radius arc is encountered in the sending system's data base, the preprocessor should ignore it.

Alternatives 1 and 2 combined, allow the maximum amount of information to be transferred via the Specification, and allow any presently existing IGES file to be read. Alternative 3 has the advantage that the entire burden is placed on the preprocessor; however it does not allow for the transfer of zero radius arcs. Existing files which contain zero radius arcs would not necessarily be readable under this proposal.

Although it is likely that zero radius arcs represent user or system error, it might be unwise to completely disallow their existence in IGES files.

Selected Methodology:

Preprocessor:

  Zero radius arcs are invalid in the IGES Specification
  (see section 4.3, Version 5.0) and should not be written
  to the IGES file as an arc entity. An appropriate
  message should be issued.

Postprocessor:

  If a zero radius arc is encountered, it should be
  skipped and an appropriate message should be issued.

RP 16: TRANSLATION VECTOR

Category: Software Practice   **IGES Document Version:** All

Keywords: Transformation Matrix   **Affected Processors:** Post

        Matrix Processing   **Affected Entities:**

                                        Transform. Matrix (124)

Problem Statement:

Postprocessor: Some systems do not handle translation vectors. Those systems that store a rotation matrix as part of the internal entity representation incur an additional processing burden in handling translation vectors.

Alternatives Considered:

Use of the translation vector in preprocessing into the Specification is not to be discouraged. It is reasonable to assume that any preprocessor making use of this feature does so with justification. Correct postprocessing of IGES data involving a translation vector is to be encouraged. For receiving systems that store only a rotation matrix, correct postprocessing involves a computational overhead of a matrix multiplication and a vector addition. The rotation matrix in the IGES data remains as the correct rotation matrix in the receiving system. This is not considered a burdensome situation relative to the alternative position of recommending that translation vectors not be inserted in the IGES data.

Selected Methodology:

A procedure for postprocessing IGES data containing a translation vector is suggested.

Rationale:

Entity data expressed in the Specification which utilizes both a rotation matrix and a translation vector is of the form

       Rx + v

where **R** is the 3 by 3 rotation matrix, **v** is the translation vector, and **x** is the vector of definition space coordinates. For systems accommodating only a rotation matrix, the origin of

definition space necessarily coincides with the origin of model space. If such a system is to postprocess entity data of the above type, for which the origins do not coincide, the definition space coordinates in the receiving system must be adjusted to absorb the translation vector.

To absorb the translation vector, the quantity $\mathbf{Rx + v}$ must be expressed as $\mathbf{R(x + u)}$ for some vector $\mathbf{u}$. Then, in the receiving system, $\mathbf{R}$ is still the rotation matrix, and $\mathbf{(x + u)}$ is the vector of definition space coordinates.

The vector $\mathbf{u}$ is $\mathbf{R^{-1}v}$. This can be seen from the following:

$$\mathbf{Rx + v = Rx + RR^{-1}v = R(x + R^{-1}v) = R(x + u)}.$$

RP 17: MODEL SPACE SCALE

Category: Software Practice   **IGES Document Version:** All

Keywords: Global Parameter 13   **Affected Processors:** Both

           Model Space Scale   **Affected Entities:** None

           Global Section

Problem Statement:

Clarification is needed on the interpretation of Model Space Scale (PDDI Report, pg. 93).

Selected Methodology:

Preprocessor:

1. If the model in the CAD system is a scaled model (*e.g.*, quarter scale), the preprocessor should assign the following values for Global Parameter 13:

$$\text{Model Space Scale} = \frac{\text{Model Coordinate}}{\text{Real World Coordinate}}$$

For example, for a one-quarter scale model, this model space scale is 0.25. Coordinate values assigned by the preprocessor will be "model" coordinates.

2. If the model is not a scaled model, the preprocessor should assign Global Parameter 13 as 1.0. Coordinate values assigned by the preprocessor are "real world" coordinates.

Postprocessor:

1. If the postprocessor encounters a Global Parameter 13 value of 1.0, coordinate values are in real world coordinates.

2. If the postprocessor encounters a Global Parameter 13 that is not equal to 1.0, the postprocessor should provide the user with two options and inform the user of the option taken.

Option 1: Create a scaled model: Coordinate values in the IGES file are model coordinates and should be used directly.

Option 2: Create a full scale model: Coordinate values in the IGES files should be divided by Global Parameter 13.

$$\text{Native Coordinate} = \frac{\text{IGES File Coordinate}}{\text{Global Parameter 13}}$$

Note: This Recommended Practice applies only to coordinate values. It does not apply to other values such as arrow height or text box height.

RP 18: PROCESSING MACRO ENTITIES

Category: IGES Description

Keywords: MACRO PD Parameter

Parameter Data

IGES Document Version: All

Affected Processors: Both

Affected Entities:

MACRO Definition (306)

MACRO Instance
(600-699 & 1000-9999)

Problem Statement:

The syntax of the macros is considerably different from anything else in the Specification. Specifically, the word MACRO in the parameter section caused some processing problems (PDDI Report, pg. 84).

{ This RP has been deleted - its content contradicted IGES }

RP 19: INDEPENDENT AND DEPENDENT PROCESSING

Category: Hierarchy Rule   **IGES Document Version:** All

Keywords: Subord. Entity Switch   **Affected Processors:** Both

        Directory Entry   **Affected Entities:** None

Problem Statement:

There is confusion as to the meaning and use of the Subordinate Entity Switch.

Selected Methodology:

Physical dependency means that the subordinate entity cannot exist in the native system unless the superordinate entity exists. Logical dependency means that the subordinate entity can exist alone, but that it will also be part of some sort of logical grouping in the native database. The implications of the above definition are as follows:

1. The matrix pointed to by the logically superordinate entity has no effect on the subordinate entity's physical location.

2. An entity cannot be physically and logically dependent upon the same superordinate entity.

3. When an independent entity is encountered, it should be immediately added to the native database.

4. When a physically dependent entity is encountered, it should not be added to the database, since it cannot exist alone. It will be processed and added to the database when its physically superordinate entity is processed.

5. When a logically dependent entity is encountered, it should be immediately added to the database since it can stand alone, but some mechanism should be devised so that when the logically superordinate entity is processed, the logically subordinate entity can be located in the native database and have the logical connection established.

Below are several examples.

Subordinate Entity	Superordinate Entity	Relationship
witness line	linear dimension	physical
conic	subfigure definition	physical
line	group (402, forms 1, 7, 14 & 15)	logical
leader line	radial dimension and group	physical logical
arc	subfigure definition and group	physical logical

RP 20: BACK POINTERS IN VIEW ASSOCIATIVITY

Category: IGES Description

Keywords: View Associativity

IGES Document Version: All

Affected Processors: Both

Affected Entities:

> Views Visible Assoc.
> (402, forms 3 & 4)

Problem Statement:

The Views Visible Associativities (402, forms 3 & 4) can be unnecessarily complex for a preprocessor to build. The term "related entities" means that the entities are to be associated with all the views pointed to by the View Associativity. The View Associativity points to the related entities in class 2 and the related entities point to the views associativity in the DE view pointer field.

{ This RP has been resolved by IGES Version 5.0}

RP 21: COMMENTS IN PARAMETER DATA RECORDS

Category: Software Practice   **IGES Document Version:** All

Keywords: Comment   **Affected Processors:** Pre

        Affected Entities: All

Problem Statement:

Comments may follow the end of record delimiter in the Parameter Data (PD) section. Implementors are reminded of this fact. A postprocessor should be able to bypass any comment records after the last PD parameter of the entity.

Selected Methodology:

The comment field starts after the end of record delimiter and may extend for several records. The Directory Entry (DE) back pointer field, section code ("P"), and sequence number are required on all PD records including comment records. The DE field 14 (PD line count) must include all comment records in the PD section.

RP 22: BOUNDED PLANES

Category: Entity Mapping   **IGES Document Version:** All

Keywords: Bounded Plane   **Affected Processors:** Post

        Bounding Curve   **Affected Entities:**

        Unbounded Plane   Plane (108)

Problem Statement:

Some systems that do not support bounded planes nevertheless postprocess them as unbounded planes. In such cases there is a danger that the bounding curve, which is flagged as a subordinate entity, may not be postprocessed and that this information will be lost.

{ This RP has been resolved by IGES Version 4.0 }

RP 23: RULED SURFACE DISCONTINUITY

Category: Software Practice

Keywords: Composite Curve

        Slope Discontinuous

IGES Document Version: All

Affected Processors: Both

Affected Entities:

        Composite Curve (102)

        Ruled Surface (118)

Problem Statement:

A ruled surface that has a slope discontinuous composite curve as one of its defining curves will have a corresponding slope discontinuity.

Alternatives Considered:

1. Disallow use of a composite curve in defining a ruled surface.

2. Allow use of a composite curve in defining a ruled surface and issue an appropriate warning.

Selected Methodology:

Alternative 2

RP 24: REPRESENTATION OF LINEAR STRINGS

Category: Entity Mapping

Keywords: Linear Spline

            Circular Arc

IGES Document Version: All

Affected Processors: Both

Affected Entities:

      Circular Arc (100)

      Composite Curve (102)

      Copious Data (106)

      Line (110)

      Parametric Spline (112)

      Parametric Surface (114)

      B-spline Curve (126)

      B-spline Surface (128)

Problem Statement:

In many systems, there are entities represented by lines and "spars" displayed between a series of coordinates. These entities have no one-to-one counterpart in terms of naming conventions in the IGES Specification. A common definition is proposed so that different vendors can successfully transfer this type of data between systems.

Alternatives Considered:

1. Use the Copious Data Entity (106) for entities consisting entirely of line segments;

    Advantage: Simple to define, concise.

    Disadvantage: Risks encouraging use as a catch-all for anything dealing with line graphics.

2. Use the Composite Curve Entity (102) for entities which point to lines and circular arcs representing each segment.

Advantage: Handles mixtures of lines
                  and arcs.

Disadvantage: Complicated structure.

3.   Use the Rational B-spline Entity.

Advantage: The definition of the IGES B-spline Entity
                  includes a "class" field to describe it. This
                  is the closest one-to-one entity corres-
                  pondence not in the catch-all category.

Disadvantage: Creates longer entity definitions than the
               first two alternatives.

Selected Methodology:

Since the primary disadvantage of alternative 3 is longer
processing time due to definition length, any reasonable
alternative that takes considerably less processing time should
be selected. Alternative 1 provides a clear, concise definition
in a fraction of the space and executes in a fraction of the time
taken by other options.

For entities consisting entirely of line segments, use
alternative 1. For entities containing circular arcs or other
curves, use alternative 2.

RP 25: MINIMUM USER INTENDED RESOLUTION

Category: Performance   **IGES Document Version:** All

Keywords: Global Parameter 19   **Affected Processors:** Both

        Minimum Resolution   **Affected Entities:** None

        Global Section

Problem Statement:

There is confusion as to the proper setting and use of Global Parameter 19 (Minimum Intended Resolution).

Alternatives Considered:

The description of the Minimum User-intended Resolution (MUR) in the IGES Specification, Version 5.0, states:

> *This parameter indicates the smallest distance in model space units that the system should consider as discernible. Coordinate locations in the file which are less than this distance apart should be considered to be coincident.*

Coincident point testing is needed for identifying:

o   a circle from a small arc

o   a valid piecewise continuous composite curve

o   a valid unit vector

o   a valid line length

o   valid start and terminate points lying on a conic or an arc.

o   positional continuity requirements implied at the interior breakpoints of a Parametric Spline Curve Entity (112). A breakpoint $T(i)$ is on an interior breakpoint if $1<i<n+1$ where the breakpoints of the parametric spline curve are $T(i)$, $(i=1,...,n+1)$ where the parameter H has a value of 0, 1 or 2. Note the coincident point tolerance is not used to test for the slope continuity or curvature continuity.

When testing for coincident points, two testing schemes could be used:

   1.   box metric, and

   2.   Euclidean metric.

The box metric testing scheme considers whether a point lies within a box (2-D square or 3-D cube) centered on another point. The sides are twice the value of the MUR. This scheme can produce inconsistent results depending on the orientation of geometry. An example of this is a horizontal line and a diagonal line, both with a size just larger than the MUR. The end points of the horizontal line would not be considered coincident, but the end points of the diagonal line would be considered coincident.

The Euclidean metric testing scheme considers whether a point lies within a radius (2-D circle or 3-D sphere) centered on another point. This scheme produces consistent results independent of the geometry's orientation. The expense of this scheme is that it involves squaring each delta coordinate, which slows down processing time.

It should be noted that some IGES processor implementors have no control over the coincident point testing schemes used in their system's geometric modelers.

Selected Methodology:

One coincident point scheme should be used throughout the IGES processor and its geometric modeler. It is more important that the preprocessor and postprocessor use the same method than which method is used. When both systems do not use the same method, errors may occur.

Each processor should document its coincidence testing method so users will be aware of possible critical discrepancies.

RP 26: ARROWHEAD AND LEADER LINE DATA

Category: Entity Mapping

Documentation

Keywords: Leader Line

Arrowhead

IGES Document Version: All

Affected Processors: Both

Affected Entities:

Leader (214)

Witness Line
(106, form 40)

Problem Statement:

IGES preprocessors and postprocessors handle leader lines and arrowheads differently. (PDDI Report, Task 1, pg. 71)

Selected Methodology:

Preprocessors should use the form number for the Entity Type 214 which matches the native arrowhead within a family.   If the arrowhead in the native system does not match any IGES arrowhead, the preprocessor should select the Type 214 form number which most closely matches. The user should be informed, either in the user documentation or by means of a warning message, of the action taken.

Postprocessors should select the native arrowhead that matches the IGES arrowhead identified by the Type 214 form number. If the system does not have an arrowhead that exactly matches the IGES arrowhead, it should select a native arrowhead that most closely matches the IGES arrowhead. The user should be informed, either in the user documentation or by means of a warning message, of the action taken.

Family	Form #
triangular	1,2,3,11
circular	5,6,12
rectangular	7,8
line	9,10

RP 27: LIMITATIONS ON LEVEL IDENTIFIERS

Category: Entity Mapping   **IGES Document Version:** All

Keywords: DE Level Number   **Affected Processors:** Both

                                       Affected Entities: All

Problem Statement:

Levels allowed on each system vary from 1 to xxx depending upon
the vendor. Consequently, levels in excess of the maximum need
a consistent way of being processed.

Alternatives Considered:

A variety of mapping methods have been proposed or are in use.
They are examined below.

1.   **Wraparound.** Entities on layer x are mapped to layer y
     where $y = MOD((x - k), (Ns + 1 - k)) + k$ where k is the
     lowest level and Ns is the number of supported levels
     on the receiving system.

2.   **Fill empty levels.** A search is performed for levels
     whose number is less than or equal to Ns and which have
     entities assigned; assume Ne entity levels are found.
     The first Ne levels on which entities are defined out-
     of-range are mapped to the empty levels. Remaining out-
     of-range levels are mapped by alternative 1.

3.   **Use nearest level.** Out-of-range levels are mapped to
     the highest and lowest supported levels, respectively.

4.   **User defined.** The user explicitly specifies the mapping
     relationship between levels by creating or referring to
     a mapping table.

Selected Methodology:

It is suggested that the user be given the capability of choosing
from options 1 to 4, the default method being wraparound. The
postprocessor should inform the user of the mapping relationship
it has applied.

RP 28: SINGLE/DOUBLE PASS PROCESSING

Category: Software Practice   **IGES Document Version:** All

Keywords: Multiple Pass   **Affected Processors:** Post

Single Pass   **Affected Entities:** All

Problem Statement:

Is it more appropriate to process an IGES file with a single or multiple pass approach? The concern is whether a single-pass postprocessor can completely process all of the data.

Selected Methodology:

To preserve functionality, a postprocessor cannot process structure in a single pass. Therefore, multiple passes are recommended.

RP 29: SPLINE CURVES AND SURFACES

Category: Entity Mapping   **IGES Document Version:** All

Keywords: Spline Curve   **Affected Processors:** Pre

          Spline Surface   **Affected Entities:**

                              Parametric Spline (112)

                              Parametric Surface (114)

                              B-spline Curve (126)

                              B-spline Surface (128)

Problem Statement:

Parametric Spline Curve and Surface Entities need to be enhanced so (1) they may reside in an arbitrary dimensional image space, and (2) their underlying polynomials may be of arbitrary degree.

Alternatives Considered:

1. Extend and enhance the Parametric Spline Curve and Surface Entities (112, 114).

2. Extend and enhance the Rational B-spline Curve and Surface Entities (126, 128), while providing algorithms to convert between Parametric Spline and Rational B-spline Curve and Surface Entities of arbitrary dimensionality and degree.

Selected Methodology:

Use Rational B-spline Entities (126, 128) instead of Parametric Spline Entities (112, 114) unless considerations dictate otherwise.

Rationale:

1. Parametric Spline Curve and Surface Entities (112, 114) can be fully captured without approximation by the Rational B-spline Curve and Surface Entities (126, 128) which are more general.

2. To avoid redundancy, Entity Types 112 and 114 will be corrected but not enhanced. All enhancements will occur

within the context of the Rational B-spline Entities (126, 128).

3.   Coded procedures are available from the **National Institute of Standards and Technology.** These procedures translate between arbitrary dimensional, arbitrary degree, rational spline curves and surfaces defined by Parametric Spline Entities (112, 114) and Rational B-spline Entities (126, 128).

   These procedures enable those with implementations in their native databases of parametric spline-like entities to use IGES Rational B-spline Entities (126, 128).

4.   Rational B-spline Entities already allow for polynomials of arbitrary degree and will be enhanced to allow for multi-dimensional image spaces.

Category: Software Practice   **IGES Document Version:** All

Keywords: Global Parameter   **Affected Processors:** Both

          Default Value   **Affected Entities:** None

          Required Parameter

Problem Statement:

There is a great deal of confusion and inconsistency in assigning default values for parameters in the Global Section of an IGES file. There are also diverse opinions on which of the parameters are required. This Recommended Practice will show which parameters are required, and the default value which may be assumed for each parameter that is not required.

Selected Methodology:

The table on the following page shows, for each parameter in the Global Section, whether the parameter is required, and if not required, the default value to be assumed. This table should be used by preprocessors in determining which values to include, and whether the assumed default values are appropriate. The table should be used by postprocessors in determining which default values to assume in the absence of a parameter value. If a required parameter is not supplied, the postprocessor may have to abort its processing, depending on the critical nature of the data.

Global Parameter	Required	Default Value
1. Parameter Delimiter	no	","
2. Record Delimiter	no	";"
3. Product ID from Sender	yes	none
4. File Name	(1)	none
5. System ID	yes	none
6. Translator Version	yes	none
7. No. Bits for Integer	yes	none
8. Single Precision Magnitude	yes	none
9. Single Precision Significance	yes	none
10. Double Precision Magnitude	(2)	none
11. Double Precision Significance	(2)	none
12. Product ID for Receiver	no	GP3
13. Model Space Scale	no	1.0
14. Unit Flag	yes	none
15. Unit Description	(3)	(4)
16. Max. Number of Line Weights	(5)	1
17. Size of Max. Line Width	no	0.0
18. Date/Time File Generated	yes	none
19. Min. User Intended Resolution	yes	none
20. Approx. Max. Coordinate Value	no	none
21. Name of Author	no	none
22. Organization	no	none
23. IGES Version	no	3
24. Applicable Drafting Standard	no	0
25. Date/Time Model Created	no	none

(1) Required if External Reference used
(2) Required if double precision used
(3) Required if GP14 = 3
(4) String appropriate for GP14
(5) Required if line weight is significant

Table Item Description:

The information contained in the above table is the result of
many hours of discussion. In the paragraphs which follow, each
parameter will be defined and discussion will be presented of
either the need for the parameter or the reasons behind the
default value chosen.

1. **Parameter Delimiter.** This parameter defines the
   character to be used to separate parameters in a list
   in a free format record (*i.e.*, in the Global and
   Parameter Data Sections). It is not required, and its
   default value is established by the IGES document as
   the string ("1H,,").

2. **Record Delimiter.** This parameter defines the character to be used to signify the end of a parameter list in free format records (*i.e.*, in the Global and Parameter Data Sections). It is not required, and its default value is established by the IGES document as the semi-colon ("1H;,").

3: **Product ID from Sender.** This parameter contains the name of the model identifier (*e.g.*, part name or number) on the sender's system which contains the model described in this IGES file.

4: **File Name.** This parameter contains the name of the data file on the sending system which contains this IGES file. It is not always used by the receiving system, and is required only when the IGES file will be the object of an external reference.

5: **System Identification.** This parameter contains the vendor's name and model designation for the sending system. This information is required. The sender's system identification can be very useful in determining how to handle error conditions if they occur during the processing.

6: **Translator Version.** This parameter consists of the version number of the vendor's IGES preprocessor used to create this IGES file, and is required. Like the system identification, it can be useful in determining how to handle processing errors.

7: **Number of Bits Used to Represent Integer Values.** This parameter is required.

8-11:
Floating Point Values Range. Parameters 8 and 10 are powers of 10 which represent the maximum value. Parameters 9 and 11 are the number of decimal digits of significance which can be actually represented on the sending system. Parameters 8 and 9 are always required and parameters 10 and 11 are required if double precision numbers are included in the file.

12: **Product Identification for Receiver.** This parameter can provide a receiver's product ID (*e.g.*, part name or number). It is not required, and if not present, the contents of Parameter 3 (Product ID from Sender) may be used.

13: **Model Space Scale.** This parameter defines the ratio between the size of items in the IGES file and the full

size of the physical object. It is not required, and if not present, is assumed to be 1.0.

14: **Unit Flag.** This parameter, along with Parameter 15, identifies the units used in creating the file. A value for this parameter is required.

15: **Unit Description.** This parameter gives a string equivalent of the units specified by Parameter 14. It is only required when Parameter 14 has a value of 3. If, in the other cases, no value is present, the postprocessor may assume the string which corresponds to the value of Parameter 14.

16: **Maximum Number of Line Weights.** This defines how many different line weights are used in the IGES file. In many cases, there is no significance to line weights and, therefore, the value for the parameter is not required. If this parameter is not specified, a value of 1 is assumed.

17: **Size of Maximum Line Width.** This parameter defines the width of the widest line used in the IGES file. It is required only if the value for Parameter 16 is present. Further, a value of 0 here means to interpret the line weight parameter as a relative number. The relative line weights are useful on a system which strokes lines: a line weight of 3 indicates that 3 standard lines are to be drawn side by side to make the final line. This is not to be used in lieu of the line-widening property.

18: **Date and Time of Exchange File Generation.** This is the date and time that the preprocessor created the IGES file. It is required to help uniquely identify the IGES file both on the sending and receiving systems.

19: **Minimum User Intended Resolution.** This parameter defines the intended accuracy of the model. It is required. See RP 25.

20: **Approximate Maximum Coordinate Value.** This value indicates the size of the model to the postprocessor. This information is necessary on some systems which have to set a scaling factor for the model before the postprocessing can begin. If a reasonable value cannot be placed in this parameter by the preprocessor, it is better to indicate that a default value is to be used for the parameter (",,") than to use an arbitrarily large (but unreasonable) value. If the default indication is used, then the postprocessor is responsible for determining the necessary value. See RP 7.

21: **Name of Author.** This information is strictly for documentation purposes. Its value to the receiving system depends on the contractual arrangements made between the sending and receiving organizations. It is not required and no default value is defined.

22: **Organization.** This information is strictly for documentation purposes. Its value to the receiving system depends on the contractual arrangements made between the sending and receiving organizations. It is not required and no default value is defined.

23: **IGES Version.** This parameter tells the postprocessor which version of the IGES specification was used to generate the file. The information is useful to the postprocessor for determining whether or not it may run into data forms or IGES features which it cannot handle. For reasons of upward compatibility, this parameter is not required. If not present, the postprocessor may assume that the Version 2.0 Specification (parameter value of 3) is indicated.

24: **Applicable Drafting Standard.** This information indicates that the creator of the model in the IGES file complied with a specific drafting standard while creating that model. The postprocessor will probably not modify any of its processing based on this parameter, but the information may be useful to the receiving system in ensuring that drafting entities added to the postprocessed model will comply with the same standard. The parameter is not required, and its default value is 0 (no standard specified).

25. **Date/Time Model Created/Modified.** Time model created or modified, whichever occurred last. Preprocessors may use the default (",,") if unknown. (V.5.0)

RP 31: HIERARCHY FLAG

Category: Hierarchy Rule   **IGES Document Version:** All

Keywords: DE Hierarchy Flag   **Affected Processors:** Pre

Directory Entry   **Affected Entities:** All

Problem Statement:

Use of the Hierarchy Flag on an entity-by-entity basis is unclear. The Hierarchy Flag set to 0 in the view, drawing, or group could cause a postprocessor to ignore the line font, level number, view pointer, blank status, line width and pen number in all entities within a view, drawing or group.

Selected Methodology:

(This RP has been resolved by IGES Version 5.0)

RP 32: ARROW AND WITNESS POINTERS

Category: Software Practice

Keywords: Witness Line

Arrowhead

IGES Document Version: All

Affected Processors: Pre

Affected Entities:

Angular Dim. (202)

Linear Dim. (216)

Problem Statement:

Dimension entities often contain two (2) leader/arrow entity pointers and two (2) witness line entity pointers. They are usually referred to as ARW1, ARW2, WIT1, and WIT2. One would normally assume that ARW1 corresponds to WIT1, etc., and some postprocessors measure the distance from the head point of the arrow to the end point of the witness line to calculate an "overshoot" for their internal database representation.

There is no requirement in IGES that this assumed relationship be maintained by the preprocessor. This information can, in fact, be established by computational examination; however, this places a needless burden on the postprocessor.

Selected Methodology:

The preprocessor should support the assumed relationship when writing an IGES file.

RP 33: ENTITY ORIGINS

Category: Software Practice   **IGES Document Version:** All

Keywords: Transformation Matrix   **Affected Processors:** Pre

         Entity Origin   **Affected Entities:**

         Identity Matrix   General Note (212)

                                       Text Display (312)

                                       Subfigure Inst. (408)

                                       View (410)

Problem Statement:

There is a problem in processing the General Note (212) and Singular Subfigure Instance (408) Entities. These entities contain explicit "origin" fields in their Parameter Data. However, any entity can be repositioned by providing a translation vector in an associated Transformation Matrix (124).

Some preprocessors set the Parameter Data for the origin to (0,0,0), and associate a Transformation Matrix Entity with the identity rotation matrix and a (X,Y,Z) translation to locate the entity. Some "simplistic" postprocessors are not designed to look for an associated translation, and consequently misplace the entity.

Worse, some preprocessors place the (X,Y,Z) in both the Parameter Data section and a Transformation Matrix; the corresponding postprocessor obviously ignores one of the values, but other postprocessors misplace the entity. Since both must be applied, the data should not be duplicated; this practice is, in fact, incorrect.

The problem also applies to the Text Display Template (312), and the View (410), which has an (X,Y) translation in the parent Drawing (404). In fact, this practice can be generalized to any current and future entities which contain an explicit origin in their Parameter Data section.

Selected Methodology:

The preprocessor should place the entity's origin in the appropriate field of the Parameter Data section, and set the translation vector in any associated Transformation Matrix (124) to (0,0,0).

However, there are legitimate reasons for valid data to be contained in both places, so all postprocessors must be prepared to handle combined situations.

RP 34: TEXT ROTATION ANGLE

Category: Software Practice

Keywords: Transformation Matrix

Rotation Angles

IGES Document Version: All

Affected Processors: Pre

Affected Entities:

General Note (212)

Text Display (312)

Problem Statement:

There is a problem in processing the General Note Entity (212). This entity contains explicit "rotation angle" and "mirror" fields in its Parameter Data. However, any entity can be reoriented by providing a rotation matrix in an associated Transformation Matrix (124).

Some preprocessors set the Parameter Data for the rotation to zero, and associate a Transformation Matrix Entity with the desired rotation matrix and a (0,0,0) translation to locate the entity. Some "simplistic" postprocessors are not designed to look for an associated rotation, and consequently misplace the entity.

The problem also applies to the Text Display Template (312). In fact, this practice can be generalized to any current and future entities which contain an explicit rotation angle in their parameter data.

Selected Methodology:

The preprocessor should place the entity's rotation in the appropriate field of the Parameter Data section.

However, there are legitimate reasons for valid data to be contained in both places, so all postprocessors must be prepared to handle combined situations.

RP 35: DUPLICATE TRANSFORMATION MATRICES

Category: Software Practice   **IGES Document Version:** All

Keywords: Transformation Matrix   **Affected Processors:** Pre

        Entity Origin   **Affected Entities:**

        Rotation Angles   Transform. Matrix (124)

Problem Statement:

Some preprocessors associate a Transformation Matrix (124) with every Circular Arc (100) even when they contain identical data.

For example, holes on a flat surface have a common normal vector, but the preprocessor gives each circle its own (identical) 124 instead of pointing at a common one. Another problem is that the preprocessor may set the origin in the Parameter Data section to (0,0) and generate 124s with identical rotation matrices but unique translation vectors.

In a slightly different vein, some preprocessors create Circular Arc entities such that the start angle is always zero (Y2=Y1), and create a Transformation Matrix which rotates it into position. In the case of the filleted corners of a cut-out on a planar surface, they could all use the same Transformation Matrix if their start and end points are adjusted.

Either of these implementations leads to needlessly large IGES files, and places a processing burden on the postprocessors.

Although the circular arc is used to illustrate the problem it also occurs in matrices associated with Subfigure Instances (408), dimension entities (200 series), and other geometric entities.

Selected Methodology:

The preprocessor should keep track of the Transformation Matrices it has generated and point to them instead of creating new ones.

However, there are legitimate reasons for creating matrices with a common normal vector; Conic Arc Entities (104) on the same plane but with different rotation angles are one example.

RP 36: EXCESS CHARACTERS IN REAL NUMBERS

Category: Software Practice   **IGES Document Version:** All

Keywords: Number Format   **Affected Processors:** Pre

        Affected Entities: All

Problem Statement:

Some preprocessors output real numbers in a fixed-length format which takes up a lot of space; in some cases, only two (2) real numbers can be placed on a line in the Parameter Data record.

Selected Methodology:

Preprocessors should use the following techniques to reduce the length of text-string representations of real numbers in the Parameter Data record.

1.   Delete leading blanks.

2.   Delete trailing zeroes.

3.   Round coordinate values to Global Parameter 19 (Minimum User-Intended Resolution). Coefficients should not be rounded.

4.   Avoid unnecessary use of scientific notation.

RP 37: REDUCE I/O OVERHEAD

Category: Software Practice   **IGES Document Version:** All

Keywords: Thrashing   **Affected Processors:** Post

          Affected Entities: All

Problem Statement:

A postprocessor can waste a lot of time thrashing the disk while trying to read an IGES file. The problem is caused by the Directory Entry records and Parameter Data records of an entity being physically distant from each other.

Consider the processing of a Linear Dimension Entity (216). The lines which contain the DE are read into a system I/O buffer (from 2K to 8K in length). Reading the lines of the associated PD record will almost certainly over-write the I/O buffer. These lines contain pointers to DE lines that were probably already in the buffer that just got over-written. Similarly, reading the next DE will over-write PD records of the subordinate entities that were read into the buffer along with the parent's PD record. Worst case (all pointers non-zero) implies twelve (12) physical reads of the disk, and the postprocessor will probably get swapped-out while waiting for the I/O.

Selected Methodology:

The postprocessor could open the IGES file with two (2) logical unit numbers; one for reading DE lines, and one for reading PD lines. The system will assign each its own I/O buffer, thus avoiding the over-write problem. Since there will be fewer physical reads, the translator should stay in-core for longer periods of time, and the translation should proceed much faster.

RP 38: UNIQUE SUBFIGURE NAMES

Category: Software Practice

Keywords: Subfigure

IGES Document Version: All

Affected Processors: Both

Affected Entities:

   Subfigure Def. (308)

   Network Subf. Def. (320)

Problem Statement:

Three variables in the IGES definition of subfigures may cause problems when exchanging data. First, IGES does not specify a naming convention for subfigures (PD field 2 of entities 308 and 320). Second, IGES does not require that a subfigure definition only appear once in any IGES file. Third, every CAD/CAM system has its own unique naming conventions for subfigures, and it cannot be assumed that a receiving system can attach any significance to these names.

Combined, it is possible for a postprocessor that wants to use the name of the subfigure, but only recognizes the first six characters, to misinterpret the information and either (a) process one definition and ignore another, or (b) process a definition and then overwrite it with a different definition.

Alternatives Considered:

1.   The preprocessor shall use a naming convention that makes each subfigure name unique within an IGES file. Upper- and lower-case characters shall not be mixed, and symbols represented by the ASCII values 0-37 Octal shall not be used at all. The naming convention will provide uniqueness in the first six characters.

     The postprocessors shall process every subfigure in the IGES file. If it requires a unique name for the subfigure, then it shall check that the name has not been used before. If the name is a duplicate, then the system may respond in one of three ways:

     a.   Ignore the definition and inform the user of the action.

b. Change the name automatically and inform the user
        of the action.

    c. Ask the user what to do.

2. The preprocessor can use any naming convention that it
    desires, but it shall only create one uniquely named
    IGES subfigure definition for each subfigure defined in
    the model.

    The postprocessor shall always assume that every
    subfigure definition in the IGES file is unique to that
    file, and must be processed to capture all required
    information.   The postprocessor shall provide a
    mechanism to make the subfigures just processed unique
    to the model created from the IGES file, such as
    mapping unrecognized characters to recognizable
    characters.

Selected Methodology:

Alternative 2 is the most accommodating approach. In both
alternatives, the idea is to create subfigures that belong
strictly to one IGES file at a time. Therefore, it is better not
to restrict the preprocessor because there might *still* be
conflicts between naming conventions on different systems. It
also puts less of a burden on the postprocessor as it does not
have to assume that the subfigure might already exist on the
system and check for it.

RP 39: EMPTY SUBFIGURES USED AS EXTERNAL REFERENCES

Category: Software Practice   **IGES Document Version:** All

Keywords: Subfigure   **Affected Processors:** Both

          Required Pointers   **Affected Entities:**

                                             Subfigure Def. (308)

Problem Statement:

Some IGES preprocessors are creating "empty" Subfigure
Definitions (308), *i.e.*, Parameter Data field 3 (number of
entities in definition) is zero. This should not be confused with
subfigure definitions that consist exclusively of entities which
are not supported by the postprocessor.

In some cases, the purpose is to exchange library subfigures,
with the expectation that a subfigure definition with no pointers
causes the postprocessor to check for geometry already in the
system under the same name. This can cause problems for
postprocessors not recognizing this mechanism. The postprocessor
may abort, or subsequent attempts to manipulate the translated
data may cause fatal errors.

This is an incomplete IGES file, and is an unacceptable
alternative to the External File Reference mechanism for passing
library subfigure data.

Selected Methodology:

Exchange library subfigures using the External File Reference
Entities and not through empty subfigures.

RP 40: SCALE IN MATRIX

Category: Software Practice   **IGES Document Version:** All

Keywords: Transform. Matrix   **Affected Processor:** Pre

                                         Affected Entities:

                                                   Transform. Matrix (124)

Problem Statement:

Some preprocessors have tried to convey the scale of an entity by embedding it in the coefficients of the entity's Transformation Matrix (124). This has been seen in the case of the Subfigure Instance (408) and View (410), neither of which are "geometric" entities. This probably is a consequence of the system's internal data representation; the determinant of such a matrix is equal to the scale, and it saves the four (or eight) bytes of an extra floating point number.

Selected Methodology:

Scale factor cannot legally be placed in the Transformation Matrix (124).

Multiplying the coefficients of a Transformation Matrix by a scaling factor is a violation of the Specification, which states that the determinant of a form 0 or form 1 matrix (associated with geometry entities) must be either positive one or negative one, and that the columns constitute unit vectors.

Scale factor for the Subfigure Instance (408) and View (410) must be placed in the explicit scale field.

RP 41: ENTITY IDENTIFIERS

Category: Software Practice   **IGES Document Version:** All

Keywords: Names   **Affected Processor:** Both

                              Affected Entities: All

Problem Statement:

Passing of entity identifier information between systems is
confusing. Entity identifiers also are known as entity tags,
names, or labels. The concept of identifiers allows users to
identify entities in the sending system and to track them in the
receiving system. IGES has the following methods:

- o Name in PD section (subfigure definition & network
     subfigure definition)

- o DE label & subscript fields

- o Name property

The name property was added to IGES because the DE fields were
too restrictive in size. The subscript field can contain only
numbers (length 8) and the label field can contain alphanumeric
data (length 8). The name property is unrestricted but adds a
great deal of size to the file because it is a separate entity.
The character string is the only useful piece of information.

The other problem has to do with uniqueness. Originally, many
CAD systems did not allow the users to tag entities so
preprocessors created unique tags. These unique tags did not
help users know what native element in the original system became
what entity in the receiving system. It also is not reasonable
to keep uniqueness if there is a one-to-many mapping when the
purpose is to track entities through multiple translations. In
any event, IGES does not require uniqueness; therefore, it should
not be assumed.

Alternatives Considered:

1. For subfigures, use PD parameters; for all other
    entities, use the name property and not the DE fields.
    This alternative would specify only one method for any
    entity type, but would increase file size.

2. Fill in the fields in a specified order, using only one
    method for a particular entity.

Preprocessor Order:

a.　For subfigures, use PD parameters.
b.　For all other entities, if the label fits into the
　　 DE fields, use those.
c.　If not, use the name property.

Postprocessor Order: The order is different from the
preprocessor, as both the name property and DE fields may
exist. If they both exist, it is reasonable to assume the
name property is the more accurate data.

a.　For subfigures, use PD parameters.
b.　Use the name property if it exists.
c.　Use the DE fields.

Selected Methodology:

Use method 2. This is the most complex, but it is efficient in
terms of file storage while still allowing complete flexibility
in name length.

Postprocessors must also handle non-unique names as uniqueness
is not required by IGES.

RP 42: UNIQUE NAMES

Category: Software Practice   **IGES Document Version:** All

Keywords: Names, Subfigures   **Affected Processor:** Post

                                                    Affected Entities:

                                                            Subfigure Def. (308)

                                                            Network Subf. Def. (320)

                                                            Name Prop. (406, form 15)

Problem Statement:

IGES files contain names such as the Subfigure Definition (308) and the Name Property (406, form 15). Many operating systems and applications have restrictions on what constitutes a valid name for files and internal names, but IGES does not contain any restrictions. Examples of system dependent restrictions are:

   Names restricted to seven characters;

   Names cannot contain underscores or special characters;

   Names must be unique.

Selected Methodology:

Postprocessors should be aware of restrictions and should implement a substitution or mapping algorithm to convert invalid names to valid names.

Rationale:

Preprocessors can't be restricted to all possible restrictions for postprocessors. Postprocessors must be robust enough to map all names.

RP 43: CLOSED AREAS

Category: Software Practice

Keywords: Closed Areas

IGES Document Version: All

Affected Processor: Pre

Affected Entities:

      Copious Data (106)

      Sectioned Area (230)

Problem Statement:

Preprocessors use Copious Data Entities (106, form 11) to create closed areas such as curves which are referenced by the Sectioned Area Entity (230).

Selected Methodology:

Preprocessors should use Copious Data Entities (106, form 63) to create closed areas.

Rationale:

Entity Type 106, form 63 includes a function that is lost with the form 11 since form 63 says it is closed and form 11 does not. The Entity Type 230 must point to geometry which is closed.

RP 44: TEXT BOX PROCESSING

Category: Software Practice

Keywords: Text

IGES Document Version: All

Affected Processor: Post

Affected Entities:

General Note (212)

Problem Statement:

Systems having fixed aspect ratios for their text have difficulties creating a text string that stays within the box height and width defined by the IGES 212 entity (see Figure 1). This problem can cause the text to overwrite surrounding geometry or text. (Systems with variable aspect ratio text do not have this problem and may disregard this recommended practice.)

Alternatives Considered:

Three methods can be used to create text on systems with fixed text aspect ratios:

1. Use both the box height and width from the IGES 212 entity and adjust text to maintain both height and width (see Figure 1).

2. Use the defined box width from the General Note Entity (212) for the text width. This usually will result in text looking like Figure 3, but can sometimes result in the string exceeding the IGES box height.

3. Use the defined box height from the IGES 212 entity for the text height. This usually will result in the string exceeding the IGES box width (see Figure 2).

FIGURE 1

FIGURE 2

FIGURE 3

FIGURE 4
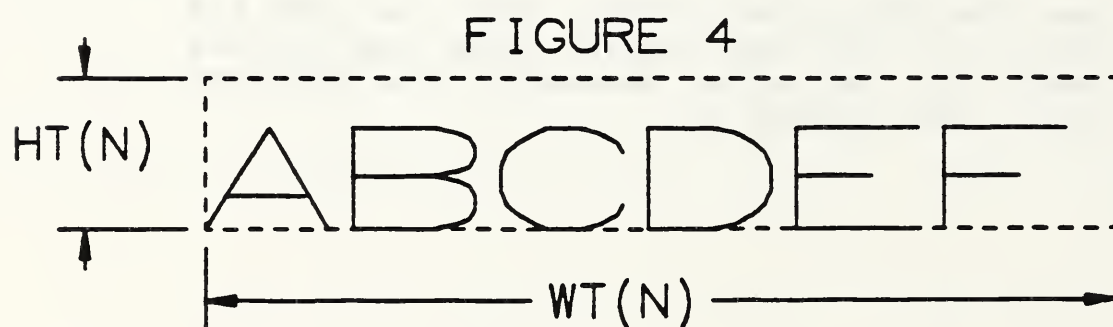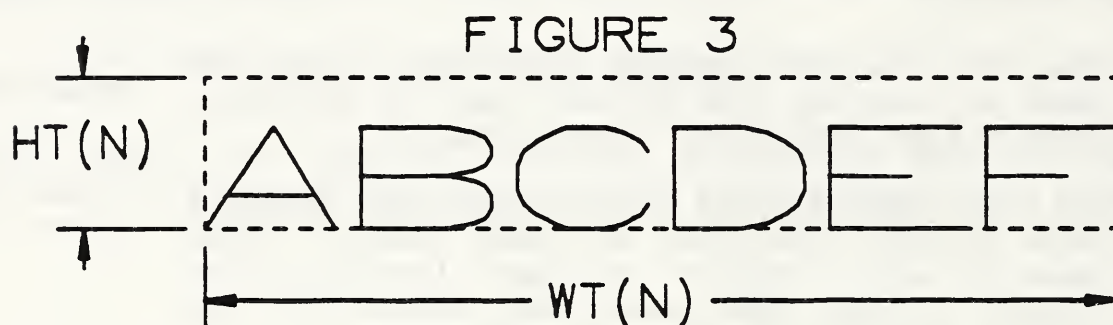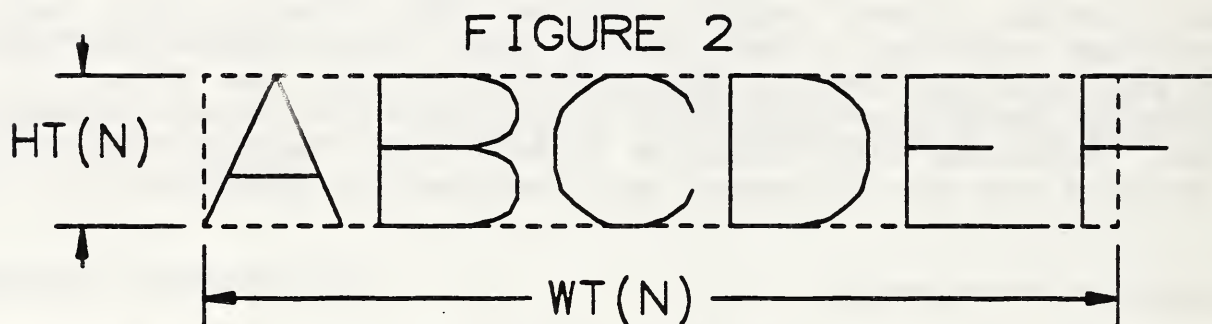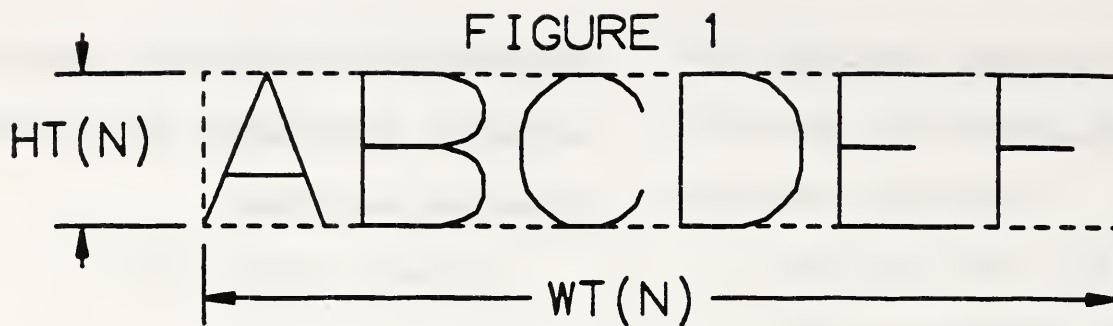
Selected Methodology:

Recommended Practices usually suggest only one way to process a particular portion of an entity. However, it was brought to the attention of the Recommended Practices Committee that different applications require different results. Implementors should study the applications being performed on their systems and should apply the appropriate method from above.

     a.   If more than one application is running on a particular system, an option should be made available which allows the user to choose the desired method.

     b.   If a switch cannot be provided, the order using the above methods should be:

        Method 1. Define text within the box
            (Figure 4)
        Method 2. Define text within the width of the box
            (Figure 3)
        Method 3. Define text within the height of the box
            (Figure 2)

RP 45: NULL TEXT STRING

Category: Software Practice   **IGES Document Version:** All

Keywords: Text   **Affected Processor:** Both

        General Note   **Affected Entities:**

        Null String   General Note (212)

Problem Statement:

Prior to IGES 5.0, the null string was not defined. The number of characters in a Hollerith string must be greater than zero; therefore, "0H," is an invalid Hollerith string parameter.

Alternatives Considered:

1. Define the null string as one blank character (*i.e.,* "1H ,").
2. Define the null string as a default parameter (*i.e.,* ",,").   Most postprocessors cannot recognize a defaulted string parameter value.

Selected Methodology:

Preprocessors should write the null string as ",,".

Postprocessors should interpret a General Note Entity (212) with one string, where the string is either one blank text string ("1H ,") or a default parameter (",,"), as a null string.

RP 46: DRAFTING SYMBOLS

Category: Software Practice   **IGES Document Version:** All

Keywords: Text   **Affected Processor:** Pre

    General Note   **Affected Entities:**

    Drafting Symbols   General Note (212)

                                            General Symbol (228)

Problem Statement:

ANSI Y14.5 drafting symbols have fixed aspect ratios, and their
widths do not correspond to normal ASCII alphanumeric characters.
In the exchange of the General Symbol Entity (228), there are
alignment problems when the symbols are used in the same strings
with alphanumerics.

Selected Methodology:

Font Characteristics (FC) 1001, 1002, and 1003 contain both ANSI
and non-ANSI special symbols. (Examples of non-ANSI symbols are
"±", "°", and Greek letters such as "pi".)

When ANSI non-alphanumeric symbols are used in General Notes
(212), they should be used in strings of a single character, with
a width as specified in ANSI Y14.5M-1982, <u>Dimensioning and
Tolerancing</u>.

APPENDIX A. PROPOSED RECOMMENDED PRACTICES FORM

INITIAL GRAPHICS EXCHANGE SPECIFICATION

PROPOSED RECOMMENDED PRACTICE

Author:_____

Address:_____

_____

Phone:_____   Ext._____

Category:_____

Keywords:_____   Affected Processors: Pre/Post

_____   Affected Entities:_____

_____   _____

Topic:_____

Problem Statement:

INITIAL GRAPHICS EXCHANGE SPECIFICATION

PROPOSED RECOMMENDED PRACTICE (cont.)

APPENDIX B. CHANGE ORDERS FOR IGES VERSION 5.0

The following Edit Change Orders (ECOs) to IGES Version 4.0 were approved by the IGES RFC Review Committee and were incorporated into IGES Version 5.0 when it was published in October, 1990. They are summarized here for the benefit of those who may not have been aware of them. For a copy of the complete ECO, contact the IPO Chairman, National Institute of Standards and Technology, Bldg. 220, Rm. A127, Gaithersburg, MD, 20899.

E500 (RFC 361A)   FILE BLANK LINES - Specifies that IGES files may have trailing blank lines (*e.g.*, to pad a disk block), but no leading blank lines.

E501 (RFC 375)   PIECEWISE-COPIOUS PARAMETRIZATION - Provides parametrizations for the Copious Data Entity (Type 106, Forms 11 & 12).

E502 (RFC 387B)   NULL POINTERS - Clarifies situations in which defaulted or "null" pointers can be used.

E503 (RFC 394)   PROCESS PLANT ATTRIBUTES - Adds predefined values to the Attribute Table Definition Entity (Type 322).

E504 (RFC 358)   LINE FONT 0 - Adds a "no line font specified" value, analogous to the "no color specified" value.

E505 (RFC 373A)   CSG DISJOINT COMPONENTS - Creates a Selected Component Entity (Type 182) for use in CSG applications.

E506 (RFC 380)   EXTENDED VIEWS VISIBLE - Creates a new Form of the Associativity Instance (Type 402, Form 19) to indicate view visibility, color, and line-style of curves based on parameterization.

E507 (RFC 283C)   PERSPECTIVE VIEW - Creates a new Form of the View Entity (Type 410, Form 1) to transfer perspective views in a form similar to the presentation methodology of PHIGS.

E508 (RFC 340A)   REDUNDANT EXTERNAL REFERENCE - Deprecates the External Logical Reference File Index Associativity Entity (Type 402, Form 2).

E509 (RFC 369A)   PATTERN HATCH ENTITY - Defines new area fill pattern codes for the Sectioned Area Entity (Type 230) to support AEC applications.

E510 (RFC 374)   COMPOSITE COPIOUS REFERENCE - The Composite Curve Entity (Type 102) may now reference a Copious Data Entity (Type 106).

E511 (RFC 379D)   BOUNDED SURFACE - Creates a new Bounded Surface Entity (Type 143) and a new Boundary Entity (Type 141).

E512 (RFC 381/382) LINEAR DIMENSION EXTENSIONS - Adds new Forms to the Linear Dimension Entity (Type 216) to indicate use as a Diameter Dimension (Form 1) or a Radius Dimension (Form 2).

E513 (RFC 383)   GENERAL SYMBOL LEADER - Clarifies the use of the Witness Line Entity (Type 106, Form 40) and Leader/Arrow Entity (Type 214) in connection with the General Symbol Entity (Type 228, Forms 1 & 3).

E514 (RFC 384)   GENERAL SYMBOL USER FORM - Reserves implementor-defined Form Numbers for the General Symbol Entity (Type 228).

E515 (RFC 388)   FEM ELEMENT ADDITION - Five new topology types are added to the Finite Element Entity (Type 136).

E516 (RFC 392)   PLANE/SINGLE PARENT - Deprecates the use of the Single Parent Associativity (Type 402, Form 9) to create holes in bounded planar regions.

E517 (RFC 398)   COMPRESSED ASCII REVISION - Revised definition of the Compressed ASCII Format for IGES files.

E518 (RFC 399)   TERMINATE REVISION - Revised definition of the Terminate Section.

E519 (RFC 404)   MATRIX ORDER - Corrects explanation of intended operation of explicitly nested Transformation Matrix Entities (Type 124).

E520 (RFC 413)   POINT DIMENSION EXTENSION - Allows the Point Dimension Entity (Type 220) to reference a Simple Closed Planar Curve Entity (Type 106, Form 63).

E521 (RFC 418)   VIEWS VISIBLE ENTITY COUNTS - The pointers
                      to entities which are affected by the Views
                      Visible Associativity Entities (Type 402,
                      Forms 3 & 4) are no longer required; for
                      backward compatibility, they are optional.

E522 (RFC 419A)   B-SPLINE WEIGHTS - Clarifies the definition
                      of a rational B-spline.

E523 (RFC 425)   SPICE PARAMETERS - Adds predefined attributes
                      for electrical applications to the Attribute
                      Table Definition Entity (Type 322).

E524 (RFC 428)   COMPOSITE CURVE RESTRICTIONS - Clarifies a
                      special case of the Composite Curve Entity
                      (Type 102) in regards to the Connect Point
                      Entity (Type 132).

E525 (RFC 429)   SIMPLE CLOSED CURVE - Adds a definition of a
                      Simple Closed Curve to the Glossary.

E526 (RFC 430)   106/63 CLARIFICATION - The Simple Closed Area
                      Entity (Type 106, Form 63) has been renamed
                      Simple Closed Planar Curve.

E527 (RFC 389)   TABULAR DATA PTYPE=12 - Clarifies Nodal
                      Loads/Constraint Data in the Tabular Data
                      Form of the Property Entity (Type 406, Form
                      11).

E528 (RFC 390)   UNITS DATA ENTITY - Creates a Units Data
                      Entity (Type 316) for use in FEM
                      applications.

E529 (RFC 335)   BINARY TO APPENDIX - Deprecates the Binary
                      Format for IGES files.

E530 (RFC 370C)   PREDEFINED LINE FONT PATTERNS - Creates a new
                      Form of the Property Entity (Type 406, Form
                      19) to identify AEC line font patterns.

E531 (RFC 414A)   8-BIT ASCII - Clarifies the prohibition
                      against 8-bit ASCII characters in IGES files.

E532 (RFC 432A)   USER/IMPLEMENTOR DEFINED - Changes all
                      references of "user defined" to "implementor
                      defined".

E533 (RFC 436)   VIEW CLIPPING PLANES - Permits use of the
                      Unbounded Plane Entity (Type 108, Form 0) for
                      clipping planes referenced by a View Entity
                      (Type 410).

E534 (RFC 377B)   HIGHLIGHT AND PICK PROPERTIES - Creates two
                      new Forms of the Property Entity (Type 406,
                      Forms 20 & 21) to communicate "highlight" and
                      "pick".

E535 (RFC 316)   DIMENSION ORIGIN LEADER (214/12) - Creates a
                      new arrowhead style for the Leader (Arrow)
                      Entity (Type 214).

E536 (RFC 372)   B-REP SURFACES - Creates new entities for
                      Boundary Representation (B-REP) surfaces.
                      (This ECO was canceled by E587.)

E537 (RFC 376)   UNIFORM RECTANGULAR GRID PROPERTY (406/22) -
                      Creates a new Form of the Property Entity
                      (Type 406) to exchange rectangular grids on
                      drawing sheets.

E538 (RFC 378B)   DRAWING WITH ROTATED VIEWS (404/1) - Creates
                      a new Form of the Drawing Entity (Type 404)
                      to exchange drawings with rotated views.

E539 (RFC 406)   APPENDIX   SAMPLE   FILE   -   Replaces   the
                      Electrical Part Sample file in Appendix A of
                      the Specification with the file from the
                      Electrical Application Guide.

E540 (RFC 431)   NULL STRING - Adds an entry to the Glossary
                      Appendix to define the Null String.

E541 (RFC 440)   NEW ORDINATE DIM FORM # (218/1) - Creates a
                      new Form for the Ordinate Dimension (Type
                      218) containing both a Witness Line and a
                      Leader (Arrow).

E542 (RFC 442)   CONNECT   POINTS   IN   NETWORK   SUBFIGURES   -
                      Creates   an   explicit   linkage   between   the
                      Connect Point entities (Type 132) in a
                      Network Subfigure Definition entity (Type
                      320) and the Network Subfigure Instance
                      entities (Type 420) which reference it.

E543 (RFC 445A)   STANDARD BLOCK FONT - Changes the name of
                      font characteristic (FC) 1 in the General
                      Note Entity (Type 212).

E544 (RFC 446)   GLOBAL PARAMETER 16 DEFAULT - Provides a
                      default value for Global Parameter 16
                      (Maximum Number of Line Weight Gradations).

E545 (RFC 448)   RENAME GLOBAL PARAMETER 17 - Changes the name
                      of Global Parameter 17 from "Size of maximum

line width" to "Width of maximum line weight".

E546 (RFC 395A) CONNECTIVITY DEFAULT POINTERS - Clarifies the descriptions of certain pointers in Entity Types 132, 320, and 420.

E547 (RFC 437E) KANJI GENERAL NOTE - Adds support for the Japanese national character set (JIS C 6226-1983) as a new font characteristic (FC 2001) in the General Note Entity (Type 212).

E548 (RFC 451) MACRO ENTITY TO APPENDIX - Move the definition of the Macro Entity (Type 306) to the Unimplemented Entities ("Gray Page") Appendix.

E549 (RFC 454) PLACEMENT OF DRAFTING SYMBOLS - Adds a figure giving examples of text-height and text-width as it applies to the display of drafting symbols defined in ANSI Y14.5M-1982 - Dimensioning and Tolerancing.

E550 (N/A) ERRATA FROM VERSION 4.0 - (editorial tracking) The IGES Editor is directed to add the errata for IGES Version 4.0 to the Working Draft for the next version.

E551 (N/A) REORGANIZE AND ORDER ENTITIES - (editorial tracking) The IGES Editor is directed to reorganize the Working Draft of the next version as needed to accomplish the goal of listing the entity definitions in ascending order by Entity Type Number.

E552 (N/A) CONSISTENCY OF PD SUBSECTIONS - (editorial tracking) The IGES Editor is directed to make consistent appearance of vertical dots, the phrase "or zero", and the phrase "Pointer to the DE of the ..." in the PD subsections of each entity definition.

E553 (N/A) CORRECTIONS TO EXAMPLE PART FILE - (editorial tracking) The IGES Editor is directed to add a corrected version of the Appendix A Example 3 IGES file (Drawing and View Example).

E554 (N/A) CHANGE BARS - (editorial tracking) The IGES Editor is directed to devise a practical method of indicating ECO changes since Version 4.0 of the Specification.

E555 (N/A)   REMOVE SUBSECTION NUMBERS ON DE & PD –
                  (editorial tracking) The IGES Editor is
                  directed to remove the subsection numbers
                  from DE and PD descriptions in the entity
                  definitions.

E556 (N/A)   CORRECT FIGURE 78 – (editorial tracking)
                  Figure 78 is moved to the Grey Page Appendix
                  and replaced by a correct figure.

E557 (N/A)   PARAMETRIC   SPLINE   CURVE   –   (editorial
                  tracking) An error occurred in transcribing
                  Version 3 to Version 4; in Section 3.8 (page
                  91), in the sentence that begins "In order to
                  avoid degeneracy, ...", the phrase, "... must
                  be zero:" should be, "... must be nonzero:".

E558 (N/A)   AMEND ECO 506 (EXTENDED VIEWS VISIBLE) –
                  (editorial tracking) In section 4.3.11 (page
                  339), in the last paragraph, change the
                  phrase, "(Type 402, Form 3 or 4)" to "(Type
                  402, Form 3, 4, or 19)".

E559 (N/A)   PARAMETER DATA LISTS – (editorial tracking)
                  Corrects the Parameter Data Lists of a few
                  entities for editorial consistency.

E560 (N/A)   AMEND ECO 511 (BOUNDED SURFACE) – (editorial
                  tracking) Several of the parameter names for
                  Entity Types 141 and 143 were confusing.

E561 (N/A)   MOVE TYPES 322 & 422 FROM GRAY PAGES TO BODY
                  – (editorial tracking) The material for
                  Entity Types 322 (Attribute Table Definition)
                  and 422 (Attribute Table Instance) is moved
                  from Appendices J.8 and J.9 into the
                  appropriate locations in the body of the
                  Specification.

E562 (N/A)   MOVE FC 1003 FROM GRAY PAGES TO BODY –
                  (editorial tracking) The material for Font
                  1003 (Drafting Font) is moved from Appendix
                  J.5 into Section 4.2.9 General Note Entity
                  (Type 212).

E563 (N/A)   APPENDIX SAMPLE FILE (A.2) – (editorial
                  tracking) In the Mechanical Part Example
                  (Appendix A, Example 2) the setting of the
                  Hierarchy Flag on some of the dimensions
                  caused several postprocessors to produce
                  incorrect results.

E564 (RFC 189B)   POINT PARAMETER 4 - In the Point Entity (Type 116), parameter index 4 (PTR) is changed from "subfigure *instance*" to "subfigure *definition*."

E565 (RFC 256B)   MODEL DATE/TIME STAMP - A new parameter is added to the Global Section to record the date/time of the native model's creation or last modification.

E566 (RFC 386C)   CURVE DIMENSION ENTITY (204) - Creates a new Curve Dimension Entity (Type 204) for use in drafting applications.

E567 (RFC 405E)   IMPROVED GENERAL NOTE (213) - Creates a New General Note Entity (Type 213) for the representation of text strings, as an alternative to the Type 212.

E568 (RFC 407B)   CONFORMANCE RULES - A definition of conformance is added to the specification.

E569 (RFC 416B)   SECTIONED AREA ENTITY (230/0) - Clarifies the definition of the Sectioned Area Entity (Type 230, Form 0).

E570 (RFC 447A)   NEW 230 FORM NUMBER (230/1) - Creates a new Form Number of the Sectioned Area Entity (Type 230/1) for Inverted Crosshatching.

E571 (RFC 450A)   ASSOCIATIVITY GROUP TYPE PROPERTY (406/23) - Creates a new Form Number of the Property Entity (Type 406, Form 23) for naming Group Associativities.

E572 (RFC 452)   NEW EXTERNAL REFERENCE FORM NUMBER (416/3) - Creates a new Form Number of the External Reference Entity (Type 416, Form 3) for referencing native parts instead of IGES files.

E573 (RFC 455A)   LEVEL TO PWB LAYER MAP (406/24) - Creates a new Form Number of the Property Entity (Type 406, Form 24) for mapping exchange file levels to Printed Wire Board layers.

E574 (RFC 459A)   PWB ARTWORK STACKUP (406/25) - Creates a new Form Number of the Property Entity (Type 406, Form 25) for representing Printed Wire Board Artwork.

E575 (RFC 461A)   PWB DRILLED HOLE (406/26) - Creates a new
                     Form Number of the Property Entity (Type
                     406, Form 26) for representing drilled holes
                     in Printed Wire Boards.

E576 (RFC 462A)   CONNECT POINT EXTENSION - Adds new Pin Type
                     and Pin Function values to the Connect Point
                     Entity (Type 132).

E577 (RFC 464A)   REGION RESTRICTION EXTENSION - Adds new
                     constraints to the Region Restriction
                     Property (Type 406, Form 2).

E578 (RFC 465A)   PWA MANUFACTURING ATTRIBUTES - Adds a new
                     Attribute List Type (ALT=5) to the Attribute
                     Table Definition Entity (Type 322) for
                     Electrical and Printed Wire Assembly
                     Manufacturing.

E579 (RFC 469A)   GENERAL NOTE TEXT BOX - Removes the
                     requirement that text box height be preserved
                     by postprocessors.

E580 (RFC 473A/478) DE REQUIREMENTS - Removes Table 3 and places
                     the DE requirements for each entity along
                     with its PD description.

E581 (RFC 477A)   CHANGE ENTITY TYPE NUMBERS - Changes several
                     of the Entity Type Numbers assigned by
                     previous Edit Change Orders.

E582 (RFC 479A)   B-SPLINE CLOSURE PROPERTY - Clarifies the
                     term "closed" for Rational B-spline Curves
                     (Type 126) and Rational B-spline Surfaces
                     (Type 128).

E583 (N/A)   MOVE NULL ENTITY FROM GRAY PAGES - (editorial
                     tracking) The material for the Null Entity
                     (Type O) is moved from Appendix J.2 into the
                     body of the Specification.

E584 (N/A)   MOVE 214/12 ENTITY FROM GRAY PAGES -
                     (editorial tracking) The material for the
                     Dimension Origin arrowhead style (Type 214,
                     Form 12) is moved from Appendix J into the
                     body of the Specification.

E585 (N/A)   DELETE APPENDICES C & D (editorial tracking)
                     The material in Appendices C (Plant Flowsheet
                     Representation) and D (Piping Model Example)
                     is removed from the Specification.

E586 (N/A)   DELETE APPENDIX B - (editorial tracking) The
                      material in Appendix B (Electrical/Electronic
                      Product Representation) is removed from the
                      Specification.

E587 (N/A)   DEPRECATE   ECO   536   (B-REP SURFACES)   -
                      (editorial tracking) ECO 536 is cancelled;
                      the material must be reballoted as an RFC.

E588 (N/A)   CONFORMANCE RULES CORRECTION - ECO 568
                      contained the incorrect text; it was the text
                      as balloted, not as amended by the ballot
                      review. This is the correct text, and this
                      ECO supersedes ECO 568.

E589 (N/A)   PD LISTS FOR COPIOUS DATA (TYPE 106) -
                      Several ECOs make the current format of the
                      various forms of the Copious Data Entity
                      (Type 106) impractical to print as in
                      previous versions of the Specification.

E590 (RFC 392)   AMEND ECO 516 (PLANE/SINGLE PARENT) - ECO 516
                      did   not   provide   sufficient   editorial
                      instructions   to   preserve   the   upward
                      compatibility of the Specification.

E591 (N/A)   CLARIFICATION OF BOUNDED PLANES - In the
                      description of the Plane Entity (Type 108),
                      the text is not consistent with the
                      restrictions on the Form Numbers and PD field
                      5.

E592 (RFC 473)   AMEND ECO 580 (DE REQUIREMENTS) - DE
                      requirements for two of the Entity Types (134
                      and 422) contained errors that contradicted
                      the text.

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10. SUPPLEMENTARY NOTES

N/A

11. ABSTRACT (A 200-WORD OR LESS FACTUAL SUMMARY OF MOST SIGNIFICANT INFORMATION. IF DOCUMENT INCLUDES A SIGNIFICANT BIBLIOGRAPHY OR LITERATURE SURVEY, MENTION IT HERE.)

The IGES 5.0 Recommended Practices Guide has been written to assist both users and
implementors of the Initial Graphics Exchange Specification (IGES). It contains two types of
information: explanations of implementation practices that are alternatives to those document-
ed in the Specification and clarifications of ambiguities or omissions in the Specification.

12. KEY WORDS (6 TO 12 ENTRIES; ALPHABETICAL ORDER; CAPITALIZE ONLY PROPER NAMES; AND SEPARATE KEY WORDS BY SEMICOLONS)

Initial Graphics Exhchange Specification (IGES), Recommended Practices, affected entities,
affected processors, alternatives, selected methodology.

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